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ROTARY PUMP IMPELLER

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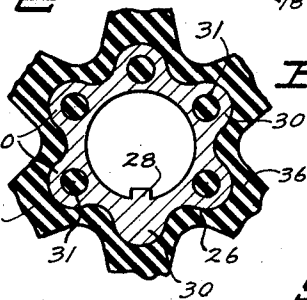
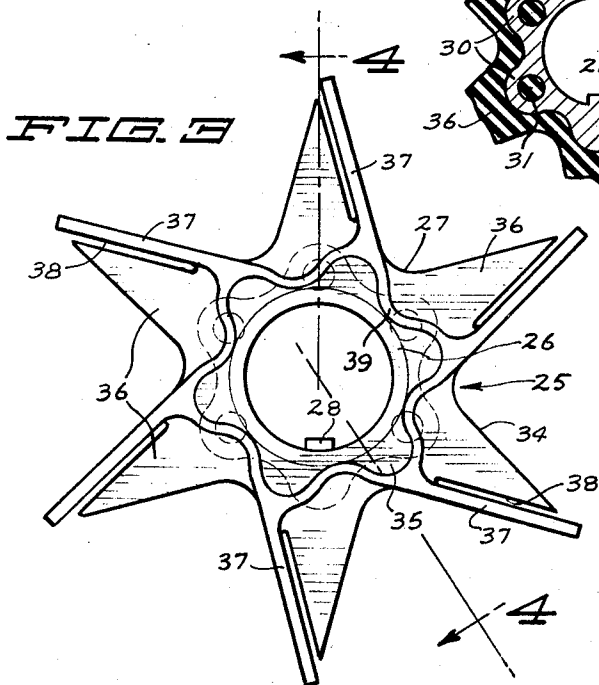
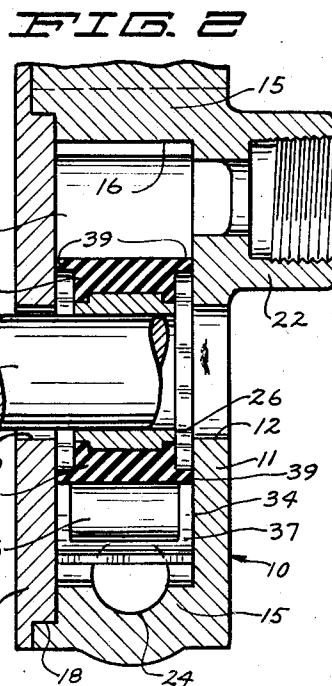
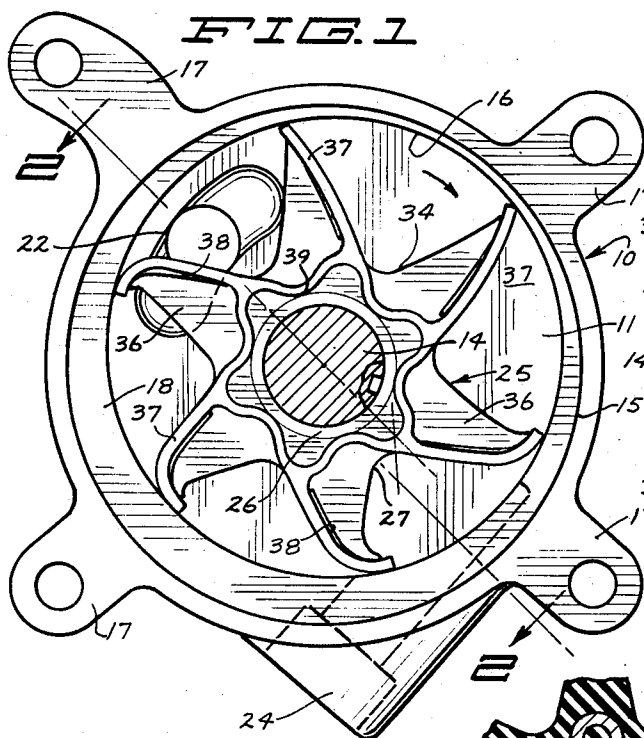
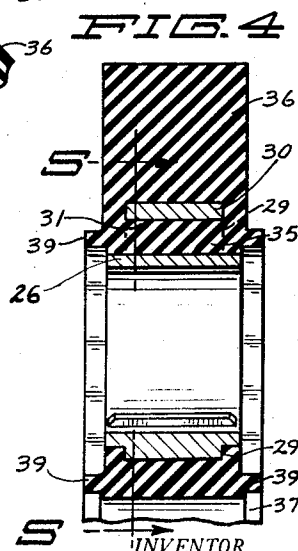


FIG. 5



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1

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ROTARY PUMP IMPELLER

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3 Claims. (Cl. 103—117)

This invention relates generally to rotary pumps and impellers therefor of the flexible vane type.

The principal object of the invention is to provide an impeller adapted for incorporation in a rotary pump such as used to circulate the cooling fluid in an outboard motor, which impeller is so constructed as to provide effective service for longer periods of time than heretofore known impellers.

A more specific object of the invention is to provide an impeller of the flexible vane or blade type wherein the blade will maintain a constant width and thickness throughout extended use in a bent condition so as to neither diminish the seal provided by or increase the interference incurred by the blade lateral edges in contact with the pump housing walls.

Another object of the invention is to provide a flexible blade impeller wherein the blades thereof will resist the taking of a permanent "set" in their flexed condition to thus preserve the seal between the end edge of blades and the pump housing wall.

Still another object of the invention is to provide an impeller for a rotary pump wherein the impeller has a continuous rib on the side wall thereof for providing a seal between the impeller drive shaft and the side wall of the pump housing and with the rib so formed as to be lubricated by the fluid pumped to thus resist wearing out and preserve its sealing engagement.

Still another object of the invention is to provide an impeller of flexible resilient material mounted on and bonded to a metallic hub and wherein the impeller and hub are so formed as to provide an improved bond therebetween which prohibits any separation or looseness between the two even after the greatest periods of use to which such an impeller is normally subjected.

With these objects in mind the invention broadly comprises a flexible vane impeller adapted to be mounted on a drive shaft for rotation in an eccentric position in a rotary pump housing, said impeller having a body portion of flexible resilient material bonded to a central metallic hub adapted to be keyed to the drive shaft, the body having a plurality of circumferentially spaced blades extending outwardly therefrom for endwise engagement with the cylindrical wall of the housing, said blades being of constant width and thickness throughout their outward extension and having a relatively thin thickness for ready flexibility, and a plurality of circumferentially spaced backing teeth extending outwardly from the body in substantially radial directions, one tooth located immediately behind each blade relative to the direction of rotation to stiffen the blade, each of said teeth being tapered in its extension from the body and being spaced, throughout substantially the entire length of its extension, away from the blade it follows.

The invention is further characterized by the provision of a continuous serpentine rib or vane on each side of the body adapted to encircle the drive shaft and provide a seal between the shaft and pump housing side wall. The central metallic hub of the impeller has a plurality

2

of circumferentially spaced transverse bores which are filled with integral portions of the body to provide a secure bond between the hub and body.

The aforementioned and still additional objects of the invention will be brought to light during the course of the following specification reference being made to the accompanying drawing in which—

Fig. 1 is a plan view of a rotary pump housing with the near end wall or pump cover removed and with the drive shaft shown in section and the impeller in operative position within the housing.

Fig. 2 is a transverse sectional view of the pump taken on line 2—2 of Fig. 1 with the pump cover in place.

Fig. 3 is a slightly enlarged plan view of the impeller removed from the pump housing.

Fig. 4 is a transverse section through the impeller taken on line 4—4 of Fig. 3.

Fig. 5 is a partial longitudinal section through the impeller taken perpendicular to the turning axis thereof and showing the bonding connection between the hub and body of the impeller.

Referring now more particularly to the drawing reference numerals will be used to denote like parts or structural features in the different views. In Figs. 1 and 2 the numeral 10 denotes generally a housing for a rotary pump. The housing has a shallow cylindrical shape with an end wall 11 provided with a centered opening 12 for reception of the drive shaft 14, such as the vertical drive shaft of an outboard motor. The circumferential wall of the housing 10 is denoted at 15 and has a varying thickness with the interior annular surface 16 thereof disposed eccentrically with respect to the opening 12 and drive shaft 14. The housing is provided with circumferentially spaced apertured mounting ears 17 and has a recessed annular shoulder 18 former on the open side thereof for seating a cover 19 which forms an end wall of the housing when mounted thereon as in Fig. 2. The cover 19 has a central aperture 20 in axial alignment with opening 12 for reception of drive shaft 14.

An interior cylindrical chamber within the housing 10 is accordingly provided by end walls 11 and 19 and the annular wall 15. The housing is provided with a fluid inlet 22 in the end wall 11 and an outlet 24 in wall 15, both of which are adapted for connection with fluid lines for free passage of fluid through the chamber 21.

An impeller 25 is mounted on the shaft 14 for rotation within the chamber 21 to force the fluid therefrom. This impeller generally comprises a hub 26 of hard, preferably metallic, material and an impeller body 27 formed of flexible resilient material such as rubber or plastic.

Hub 26 is an annular sleeve having an internal key 28 adapted to mate with a slot in shaft 14 to lock the hub to the shaft for rotation therewith. The hub has an axially reduced peripheral portion or rim 29. This rim is provided with radially extending lugs 30 spaced circumferentially around the hub. These lugs are transversely apertured as at 31. The aperture may be omitted in lug 30 opposing key 28 for greater hub strength at that point.

The impeller body is designated generally by the numeral 34. This is a unitary body of flexible resilient material such as neoprene rubber having a central portion 35 which is molded over and around the periphery of hub 26. It will be noted in Figs. 4 and 5 that the central portion 35 of the body is greater in transverse thickness than the hub rim 29 so as to completely surround the lugs 30 with the body material filling the apertures therein. The impeller body 34 is suitably bonded to the hub 26 throughout the area of their contacting surfaces. Integrally formed with the central portion 35 and extending radially therefrom are a plurality of circumferentially spaced projections or teeth 36 which are of constant width but which taper in their radial extension. These

3

projections are of substantially the same width as the hub 26 which is considerably less than the distance between opposing faces of housing walls 11 and 19 whereby when the impeller is disposed within the housing 10 there is substantial clearance between the walls and the projections. The projections 36 are preferably radially aligned with lugs 30 on the hub for maximum strength of the bond between the body and hub against separation caused by stressing of the projections 36.

The impeller vanes or blades are designated at 37 and extend outwardly from the impeller body portion 35 in a tangential direction relative to the shaft 14. These vanes are preferably flat with the broad faces thereof lying on planes which are parallel to the turning axis. Each vane is spaced just ahead of a tooth 36 as denoted at 38 with the facing surfaces of each vane and its back up tooth being parallel. The vane 37 is somewhat wider and longer than its back up tooth 36. It is also a bit wider than the space between the housing end walls 11 and 19 so as to be slightly compressed therebetween when in operative position within the housing.

At each side thereof the impeller body 34 is provided with an axially projecting continuous rib 39 adapted to encircle the drive shaft 14 and provide a seal between the shaft and the outer portions of the pump compartment. These ribs project transversely to the width of vanes 37 and connect to the inner ends thereof as shown in Figs. 1 and 3.

In their continuous extension around the shaft receiving impeller opening each rib 39 has an irregular or wavy configuration which might be referred to as "serpentine" with the blades 37 joining the ribs at the outside curves remote from the center axis. The purpose of the serpentine configuration best shown in Figs. 1 and 3 will be presently understood.

In operation in the pump the impeller is mounted on the drive shaft 14 and positioned within the housing 10 as shown in Figs. 1 and 2. The shaft is driven to rotate the impeller in the direction of the arrow in Fig. 1 and with the eccentricity of the impeller the cooling fluid is forced through the housing.

It will be understood that the vanes 37 being relatively thin throughout their length will flex very easily and are accordingly adapted to use over extended periods without breaking or taking a permanent set in a trailing direction. The projections or teeth 36 serve as back up lugs for the vanes 37 and stiffen the vanes so that they will be held firmly against the wall 16 as they are rotated for positive fluid displacement. These teeth extend a distance somewhat less than the maximum radius of the pump chamber. Thus while the tip ends of teeth 36 will flex as they move along the near portion of wall 16 they will straighten out again as they move along the far portion of the wall, reducing the possibility of their taking a permanent trailing set.

The lateral edges of vanes 37 are in sealing engagement with walls 11 and 19 and the vanes are actually compressed between the walls to assure constant contact. The thinness of the vane reduces to a minimum any variance of width of the vane along its length as the vane is flexed. This is important in preserving the lateral sealing effectiveness of the vane without increasing interference with the housing end walls.

The serpentine sealing rib 39 has a significant advantage over a circular rib in that all but the innermost crest portions thereof will pass along areas of side walls 11 and 19 which have intermittently been exposed to water. The major portion of the rib sealing surface is accordingly being constantly lubricated to decrease its susceptibility to burning out through constant friction. Also the irregularity of the ribs prohibit the wearing of circular grooves in the pump housing end walls after extended use.

The strength of the bond provided by the interlocking construction between the hub 26 and impeller body 34 will be readily appreciated. The construction disclosed

4

accordingly economically and effectively carries out the aforementioned objectives:

It is understood that suitable modification may be made in the structure as disclosed, provided that such modifications come within the spirit and scope of the appended claims. Having now therefore fully illustrated and described the invention, what we claim to be new and desire to protect by Letters Patent is:

1. In a rotary pump of the character described, a housing providing a pump chamber having parallel end walls connected by a circumferential wall, a rotary drive shaft extending through the chamber end walls and being eccentrically disposed with respect to the cylindrical wall, an impeller of molded material capable of being deformed disposed within the chamber and mounted on said drive shaft for rotation therewith, the impeller having a central mounted portion and a plurality of flexible vanes extending outwardly from the mounted portion for constant endwise engagement with the circumferential wall so that the vanes will bend substantially in a trailing direction as they pass along the eccentrically near portion of the cylindrical wall, said vanes having a normal width greater than the distance between the end walls so as to be held under compression therebetween, and the impeller having a plurality of integral backing teeth extending radially outward from the central portion to a point adjacent the tips of said flexible vanes one of said teeth being immediately behind each vane relative to the direction of rotation of the impeller to stiffen the vane as it is bent in a trailing direction, said teeth being spaced from said vanes when said vanes are in non-flexed position and narrower than the distance between the chamber end walls and being radially tapered in thickness in their outward extension.

2. An impeller for use in a rotary pump having a drive shaft comprising an annular metal hub for mounting on the shaft, a unitary impeller body of resilient deformable material having a central portion molded on the hub and a plurality of circumferentially spaced projections extending from the central portion in radial directions relative to the hub and adapted to be longitudinally flexed during operation of the impeller, the hub having a plurality of circumferentially spaced radially extending lugs projecting from the periphery thereof one into each impeller body projection, the majority of said lugs having apertures extending therethrough in axial directions with respect to the hub, and said impeller body material being formed to surround said lugs and to fill said lug apertures with the body and lugs being bonded together throughout their coextensive surfaces to resist separation of impeller body from the hub in the areas of the projections.

3. In a rotary pump of the character described, a housing providing a pump chamber having parallel end walls connected by a circumferential wall, a rotary drive shaft extending through the chamber end walls and being eccentrically disposed with respect to the cylindrical wall, an annular hub mounted on the shaft, an impeller body of molded material capable of being deformed disposed within the chamber and mounted on said hub for rotation therewith, the impeller body having a central mounted portion and a plurality of flexible vanes extending outwardly from the mounted portion for constant endwise engagement with the circumferential wall so that the vanes will bend substantially in a trailing direction as they pass along the eccentrically near portion of the cylindrical wall, said vanes having a normal width greater than the distance between the end walls so as to be held under compression therebetween, a plurality of backing teeth extending integrally outward from the central portion to points adjacent the tips of said flexible vanes and said teeth being spaced one immediately behind each vane relative to the direction of rotation of the impeller to engage and stiffen the vane as it is bent in a trailing direction, said teeth being spaced from said vanes when

5

said vanes are in non-flexed position and being narrower than the distance between the chamber end walls, the impeller body and hub being bonded together throughout their coextensive surfaces, and the hub having a plurality of circumferentially spaced radially extending lugs projecting from the periphery thereof one into each of said backing teeth to increase the areas of bond near the teeth.

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